tion for a nearer point than that on which attention is directed—a kind of spasmodic myopia, and, as such, would disappear when the power of accommodation was paralysed by atropine. On the other hand, it may not be myopia at all, the improvement given by the weak concave lens being perhaps due to the contraction of the pupil, which would occur along with the accommodation necessary to neutralise the effect of the glass. If this were the case, the improvement would also take place by the use of a suitable diaphragm held in front of the eye. Still another possible explanation suggests itself, viz. that the new dioptric combination made up of the concave lens and partially accommodated crystalline might introduce conditions of chromatic and spherical aberration which were more favourable to distinct vision. The disturbing effects of such aberration are probably greatly neutralised by the arrangement of the retinal elements, but the degree of the neutralisation is, not unlikely, dependent on the amount of absolute and relative illumination of contiguous elements.

GEO. A. BERRY

Edinburgh

The Fall of Autumnal Foliage

THE paper by Mr. Sorby in NATURE for December 4, 1884 (p. 105) opens up an unpursued inquiry into the cause of leaves falling in autumn. While Mr. Sorby has had his attention drawn to the subject by looking at the actual trees and leaves "of the fine display of autumnal tints which we have lately seen" in England, there is much of both positive and negative evidence to be drawn in two extreme directions—the tropics and the pole.

Being, in the year 1881, home from India, where, it is not necessary to say, nearly all the trees retain their green foliage throughout the year, the writer indulged in a long curiosity to see the counties of Caithness, Orkney, and Shetland He went there with reference to the luminosity, which reaches its maximum in them for Great Britain, and is very marked and exceedingly striking and beautiful as a feature all over the north of Scotland in the month of June, when it is daylight all through the hours of night, sufficiently clear for reading distinct print at twelve o'clock midnight.

A peculiarity of Caithness and the Orkney and Shetland Islands is that no forest-trees can be got to grow. Setting on one side a remark "that it was because nobody had tried," the suspicion had already occurred to my mind that there must exist some other causes than those usually asserted—the high sea winds, bleakness in winter, and extreme cold—for this want of trees.

Any one who has been much in the north of Scotland, and is at all acquainted with the optical sciences, cannot fail to have noticed the immense amount of polarised light there is from the sky; almost all the diffused daylight, except for an hour or two in the middle of the day, being plane or elliptically polarised.

The attention of readers of NATURE may with advantage be specially directed to the possibility, from the phenomena of the north, that leaves fall in autumn from trees growing above a certain latitude—about 30°—through loss of vitality in the more or less highly polarised light.

The first thing a traveller from India notices in Alexandria is the American fall of the leaves in the Grande Place, or, as a fellow-passenger once put it, pointing to these, "It is here trees first become deciduous." It is worth being remarked that, not until reaching Cairo or Alexandria, can sun-protection be done without.

So far Mr. Sorby has to refer to the action of light in the last resort, as he says, with regard to leave, "slight frosts reduce their vitality in such a manner, that the chlorophyll is changed by the action of the light into a red product."

Chlorophyll is composed of carbon, hydrogen, oxygen, and a trace of iron. Chemically it is $C_{18}H_{20}N_2O_3 + O_{18}$, resulting from the action of carbonic acid and ammonia on a fat, $C_8H_{14}O$, under the influence of light, as given by a different authority; but the composition of its products and combinations have not been traced. Still there is almost every constituent of the animal frame present except the earthy salts, and it must be a substance very sensitive to rays of light, or to what light probably is, electro-magnetic forces.

The weakening of the plant is supposed by Mr. Sorby to have occurred, for the leaves of a tree to have lost the vitality which counteracted the chemical degradation of the chlorophyll. Now in India or Ceylon, if a stalk were injured, the leaves would wither into brown. Trees remain, however, when living, constantly green, the leaves dropping off gradually one by one almost, and are immediately replaced. Indian leaves of trees are much thicker, and more of the texture of parchment than those of foliage in European countries, and the phenomena of change can be studied in evergreens without going there, Indian observation merely serving to draw attention that might not otherwise be given to the matter.

The Rothamsted experiments of Sir J. B. Lawes and Dr. Gilbert, F.R.S., bear closely on the question. They found (Swansea, 1880, address) that plants assimilate chlorophyll not only during but a small portion of the year, but the action is limited to the hours of daylight, while during darkness there is rather loss than gain. The experiments, however, both there and in Norway by Prof. Schübeler, were made in ordinary unpolarised solar or electric light.

On the other hand, in India the light is intense owing to its tropical position, and, from the altitude of the course of the sun, very slightly polarised. It is only for an hour at dawn and another hour of sunsetting that the Indian is at all the same sort of daylight that it is in England. It accords with the Rothamsted and Norwegian experiments under the continuous exposure of vegetation to daylight and electric illumination during the night that the trees in India are large and evergreen. Of course in time leaves have done their work and fade, but as they have not been unfolded simultaneously, they drop off gradually in batches.

Where, accordingly, the light is polarised, trees are scarce or absent, mown by a swathing light; and in the tropics, where there is little polarisation, they are luxuriant, and green all the year round.

This is not inconsistent with fact. To begin with, plane polarised light has half the intensity of ordinary white light, the set of vibrations at right angles to the plane of polarisation being absorbed in the reflecting matter of the sky. Besides, circularly or elliptically polarised light must largely prevail, to judge from the metallic glow there is on the Pentland Firth, Orkney, and Shetland in midsummer, and what effect circularly polarised light has on the assimilation of carbon in the leaves of plants and decomposition of chlorophyll is unknown.

At any rate, Caithness, and the northern islands have a number of hours in the daytime of a wintry darkness, and scarcely any light in the summer months and its long days that is not polarised. From this cause, which could in the leisure of their winter be put in arithmetical units of force, combined with cold winds and a thin soil, without alluvial deposits, resting on stone, it is no wonder that, though the inhabitants are not strangers to the pathos of the fall of the leaf, the Caithness-shire landscape, and the sward and heather of Orkney and Shetland are lustrous day and night with polarised light, and bare of autumnal foliage.

A. T. FRASER

India, January 22

Erosion of Glass

IN reference to the letter of Dr. Ord in last week's NATURE, glass is by no means proof against the action of either acids or alkalies, indeed its resisting seems to depend merely on its colloidal, at any rate non-permeable, nature. It may not be generally known that water alone very rapidly acts on glass, especially when it is in a finely divided state, extracting both alkalies and silica in quantity. It would be rash to put down the action of substances on glass to "molecular coalescence" to the exclusion of chemical action, or under the idea that acids or fluorine are necessary to etch glass. Alkaline salts, especially phosphates, act, either wet or dry, very vigorously on glass. One class of salts, the potassium salts of phenol sulphonic acids, have been noticed to literally tear a glass bottle in pieces, whilst crystallising out of an acid solution. Ordinary gum is often acid in reaction; but the ordinary mechanical action of sticking and then contracting is probably quite sufficient to cause an abrasion or etching, especially with soda-glass. This purely mechanical action is often noticed in the distillation of tarry substances which solidify at a high temperature, the whole interior surface of the retort being torn off and cracked in all directions.

W. R. H.

A Lantern Screen

THE optical lantern has come to be so much used for scientific and educational purposes, that you may perhaps think it useful

to your readers that a screen, whose valuable properties seem even now to be scarcely at all known, should be noted in your columns.

It simply consists of a sheet of French tracing-paper, of a kind which possesses a remarkably dull, non-reflecting surface. With this screen and only an oil-lamp lantern, it is quite easy to show pictures well to a couple of hundred people in a room fairly well lighted—sufficiently lighted indeed to enable note-taking or reference to books to be accomplished with perfect ease—provided that extraneous lights are not placed *behind* the screen.

It was to Mr. George Smith, of the Sciopticon Company, that I was indebted, four years ago, for the knowledge of this fact; which, with considerable lantern experience, I scarcely knew how to believe, until I had myself verified it.

At present, however, the tracing-paper cannot, I believe, be obtained more than three to four feet square.

CHARLES J. TAYLOR

Toppesfield Rectory, Essex, February 17

Fuller's Earth as a Filter

WHERE the *fuller's earth* is dug from the Bedfordshire greensand it is held in much repute for its efficacy in removing impurities from turbid water.[1] In addition to the other uses to which it is here applied, dealers take it around through the fen countries, and dispose of it for clarifying the peaty water,[2] often the only supply obtainable in those districts.

I shall esteem it a favour on the part of the readers of NATURE residing on the Greensand or Oolites of the southern counties to notify if these filtering properties of the Bedfordshire fuller's earth are in any way unique—in so far as they appear withheld from that of other places?—as at Reigate, Bath, &c., where fuller's earth is known to them to be dug.

Bedford, February 23 A. G. CAMERON

The Boomerang in India

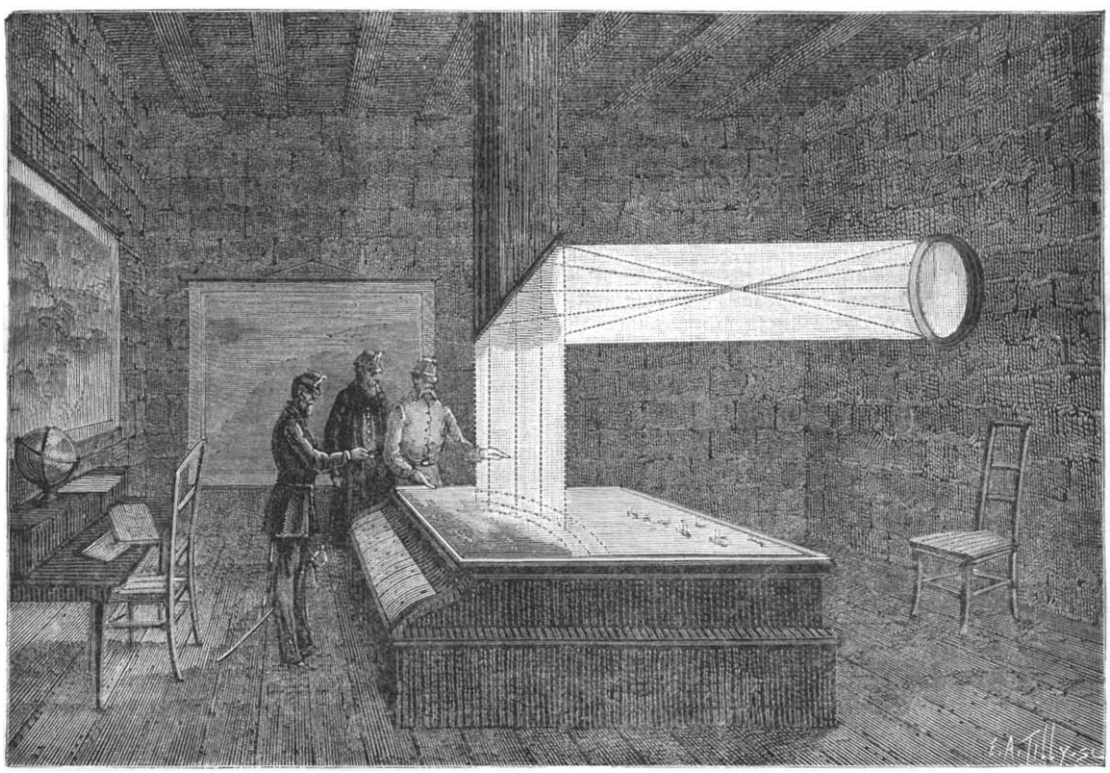
IN Gustav Oppert's work "On the Weapons, Army Organisation, and Political Maxims of the Ancient Hindus," the boomerang is mentioned as being among the weapons, especially in Southern India, and made of various materials—iron, ivory, and wood. Are any specimens to be found in our museums here, or would any private persons who may happen to possess any, kindly allow me to inspect them?

ARTHUR NICOLS

THE CAMERA OBSCURA IN TORPEDO WORK[1]

AT the time of the last Austro-Italian war, in 1866, the Austrian Government made the greatest efforts to protect its harbours from an attack of the Italian fleet. Torpedoes were placed in great numbers in the harbours, and the greatest vigilance was enjoined on all the commandants of such places.

The accompanying illustration represents a novel application of the camera for use at the observing or firing post of a party belonging to the military telegraph. The torpedoes are placed along certain concentric lines, very close to each other, and at a certain depth below the surface of the water, no sign of their presence being apparent. A metallic wire connects each of them with a post of observation situated on the coast at a point sufficiently elevated to permit of the port being seen. According to well-known optical laws, an image of the port is formed on the glass. Black points marked on that image indicates the exact position of each torpedo; these points are all numbered, each number corresponding with that on a particular key of a keyboard. To press one of these keys with the finger is sufficient to place the corresponding



[1] From *La Nature*.

[1] *Geol. Mag.*, February, 1885.

[2] A brief account of the method in use in the fen districts of Cambridgeshire and Lincoln will appear shortly.